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(54) Implementation of mutual rate adaptations in data services between GSM and DECT

(57) The invention relates to a method and equipment with which it is possible to use data services of a cellular telecommunication system, especially the GSM system, from a terminal (26) belonging to a second cellular telecommunication system, especially the DECT system. According to the invention, it is added to the base station (20) of said second telecommunication system the means (22, 23, 24, 27, 28, 30, 32, 34) required for performing the rate adaptations and mappings with which the transferred data are converted from the format of said first telecommunication system to the format of said second telecommunications system and vice versa. All changes to the current systems as required by applying the invention are made in the base station (20) near its interface to the switching centre (1), so there will be no changes as regards the user and the operation of the switching centre.

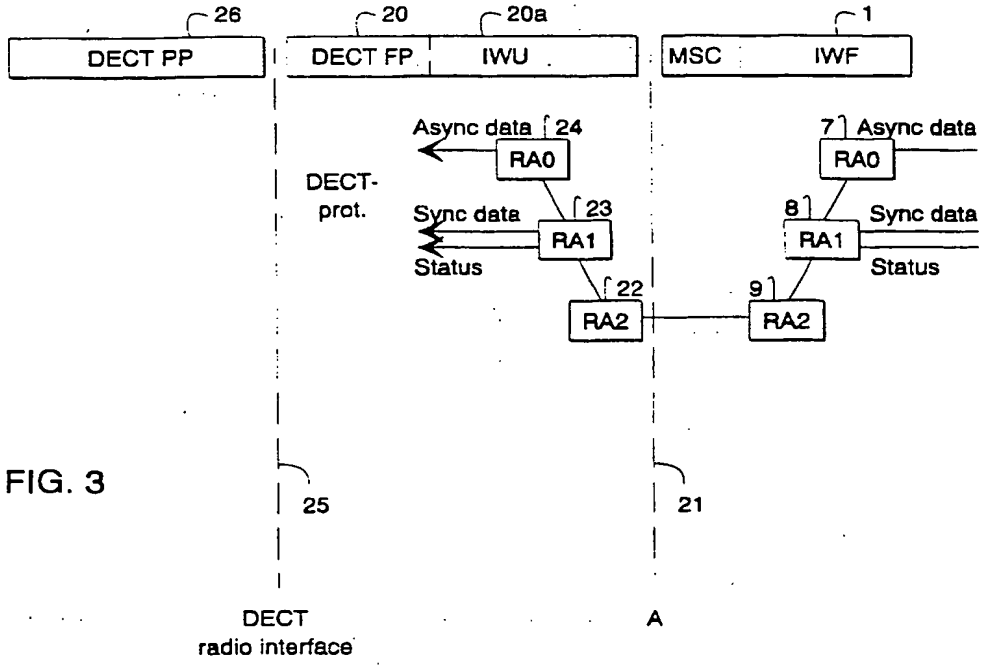

FIG. 3

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Description

The invention relates in general to the operation of a switching center and base station equipment in data communication networks, and in particular to the arrangement of their rate and protocol adaptations required for using data services provided by a cellular telecommunication system, especially the GSM system, from a terminal belonging to another cellular telecommunication system, especially the DECT system.

In digital data communications it is known several internationally standardized systems and network implementations based on them. A user of a data communication service is usually not interested in the technical details of the system or network that conveys his or her message. From the user's point of view user-friendliness means that various networks and systems can be made to work together in a versatile and reliable way, thus making it possible to use a variety of services from a terminal of any one system. In the description below we will use the GSM and DECT systems as examples.

The data communication services of both the GSM (Groupe Speciale Mobile / Global System for Mobile Communications) system and the DECT (Digital European Cordless Telecommunications) system are widely used in Europe. In both systems the principle is the same: the user has a small and lightweight portable terminal which for data communication purposes is radio-linked to a fixed base station which in turn is linked in a fixed manner to a switching centre equipment controlling the operation of the system. The systems employ different standardized functions for packetizing, encoding and modulating the data to be transferred. Data is handled according to so-called protocols, which are known to those skilled in the art. The GSM system protocols relevant to this invention and instructions for their implementation are described e.g. in the "The GSM System for Mobile Communications" by Michel Mouly and Marie-Bernadette Pautet, published by the authors, ISBN 2-9507190-0-7, Palaiseau 1992, 701 pp. The DECT system protocols relevant to this invention and instructions for their implementation are described e.g. in the following standards and documents: ETS 300 175-1 to 300 175-8, prETS 300 444, prETS 300 331, I-ETS 300 176, ETR 015, ETR 043, ETR 056, prETS 300 466, ETS 300 370 and ETS 300 xxx: "Radio Equipment and Systems (RES); Digital European Cordless Telecommunications (DECT) Data services profile, Generic data link service, Service Type C, Class 2".

It is known to connect a DECT base station, called a fixed part (FP), directly to a GSM mobile switching centre (MSC), thus making it possible to have a speech connection from a mobile telephone in a DECT system to another telephone through a GSM network. The methods so far have not, however, provided the possibility of using the varied range of GSM system data services during such a connection since there has not been a method of implementing the rate adaptations required by these services in the data communication between the systems.

It is an object of this invention to provide a method for using data services provided by a first telecommunication system from a terminal belonging to a second system. It is also an object of this invention to provide a method for implementing the rate adaptations required by the GSM system in the data communication between the DECT and GSM systems. It is a further object of the invention to provide a particularly advantageous method for implementing said rate adaptations.

In accordance with the invention, these objects may be achieved by placing the adaptation functions and communication protocols required by said first system in the base station of said second system, preferably in its interworking unit (IWU). Also the method according to the invention may provide that the rate adaptations and mappings for converting the transferred data from/to the format of said first telecommunication system to/from the format of said second telecommunication system take place in said base station.

The invention also relates to equipment for implementing the method mentioned above. Equipment according to the invention, may include a base station, which includes means for carrying out the rate adaptations and mappings with which the transferred data are converted from/to the format of said first telecommunication system to/from the format of said second telecommunication system.

The GSM system includes very precisely standardized definitions of data communication protocols and their implementation. One of the advantageous features of the GSM system is the permanence of its standards: changing of definitions is not common. On the other hand, this has been considered a disadvantage because it has been felt that adapting the system to interwork with another system is difficult. For example, in the interworking adaptation of the GSM and DECT systems, the aim has been not to make any changes in the standard GSM switching centre.

The invention in one aspect can be regarded as being based on an idea according to which the GSM standards are partly transferred to the DECT system. In order for the changes in the DECT system to be as small as possible from the point of view of an ordinary user, the adaptation between the DECT and GSM standards is proposed to be placed near the system interface. In a preferable embodiment of the invention the adaptations are placed in the DECT base station, advantageously in its interworking unit (IWU).

The idea of the invention can be applied to all systems in which the switching centre equipment is standardized so rigorously that no changes can be made in it, but in which changes in the base station equipment are possible. When applying the idea of the invention to data communication between systems other than the DECT and GSM, the standards mentioned in this description that refer to said systems naturally have to be

replaced by standards of the systems in question.

Exemplary embodiments of the invention are hereinafter described with reference to the accompanying drawings in which:

Figure 1 shows a known arrangement for providing transparent circuit switched data services in a GSM network,

Figure 2 shows a known arrangement for providing non-transparent circuit switched data services in a GSM network,

Figure 3 shows an arrangement according to the invention for providing transparent circuit switched data services between the GSM and DECT systems,

Figure 4 shows an arrangement according to the invention for providing non-transparent circuit switched data services between the GSM and DECT systems,

Figure 5 shows an arrangement according to the invention for providing transparent fax services between the GSM and DECT systems,

Figure 6 shows an arrangement according to the invention for providing non-transparent fax services between the GSM and DECT systems,

Figure 7 shows more closely the flow of data between the functional blocks of a base station using the method according to the invention in a case according to Figure 3,

Figure 8 shows more closely the flow of data between the functional blocks of a base station using the method according to the invention in a case according to Figure 4,

Figure 9a shows the messages exchanged between a terminal, a base station using the method of the invention and a switching centre when the terminal is setting up a data call,

Figure 9b shows an alternative procedure for the case of Figure 9a,

Figure 9c shows a second alternative procedure for the case of Figure 9a,

Figure 9d shows the messages exchanged between a terminal, a base station using the method of the invention and a switching centre when the terminal is receiving a data call, and

Figure 9e shows an alternative procedure for the case of Figure 9d.

Corresponding parts in the figures have the same reference numbers. The description below and the accompanying drawing concentrate on describing circuit switched data services which are used as an example. However, the method according to the invention can also be used in connection with packet switched data services.

First, referring to Figure 1 and 2, arrangements are described which, though they are known, are essential for understanding the invention, namely, arrangements for implementing data communication in the GSM system.

The following bearer services are known in the GSM system:

- data circuit duplex asynchronous: rates 300, 1200, 1200/75, 2400, 4800 and 9600 bit/s, transparent and non-transparent (T/NT),
- data circuit duplex synchronous: rates 1200, 2400, 4800 and 9600 bit/s, transparent and non-transparent (T/NT),
- PAD access circuit asynchronous (PAD = packet assembler/disassembler): rates 300, 1200, 1200/75, 2400, 4800 and 9600 bit/s, transparent and non-transparent (T/NT),
- data packet duplex synchronous: rates 2400, 4800 and 9600 bit/s, transparent and non-transparent (T/NT),
- alternate speech/unrestricted data: during a call it is possible to alternate between speech and data connection, transparent and non-transparent (T/NT),
- speech followed by data: after a speech connection of a certain duration the user can switch to a data connection during the same call but not back to speech again, transparent and non-transparent (T/NT),
- 12 kbit/s unrestricted digital, used only inside GSM.

Transparent and non-transparent data transmission imply that it is possible to have automatic error correction in the data communication. Error correction is not used in transparent data transmission, whereby the transmission rate is constant and the error ratio varies according to the network load situation and connection quality. In non-transparent data transmission the sending device packetizes the data into radio link protocol (RLP) frames which are numbered. If the receiving device does not receive a frame correctly, it may request a retransmission of the frame in question. In non-transparent data transmission the error ratio is constant, but the transmission rate varies according to the network load situation and connection quality.

Teleservices of a higher hierarchy level, such as the facsimile group 3 known to one skilled in the art, use one of the above-mentioned bearer services to convey

the data from the sending terminal through a GSM network to the receiving terminal. With the exception of the 12 kbit/s unrestricted digital data transmission all services mentioned are based on synchronous/asynchronous and transparent/non-transparent data communication at 9600 bit/s at the most. However, since the communication between the switching centre equipment (MSC) and the base station controller (BSC) controlling the operation of the base station occurs at 64 kbit/s, various rate adaptations (RA) are needed in the system.

Figure 1 is a schematic representation of a known transparent circuit switched connection between a GSM switching centre 1 and GSM terminal 2. The switching centre 1 is connected to a base station controller 3. The interface 4 between the switching centre 1 and base station controller 3 is generally called the A interface. It conforms to the CCITT (Comité Consultatif International Télégraphique et Téléphonique) standard G.703 and is capable of providing 64 kbit/s connections multiplexed at 2 Mbit/s. The base station controller 3 is further connected to a GSM base transceiver station 5 (BTS), and the interface 4a between them is called the Abis interface. Between the base transceiver station 5 and terminal 2 there is a radio interface 6.

As shown in Figure 1, the interworking functions part IWF in the GSM switching centre includes three basic rate adaptations specified in the GSM system standards, performing adaptation according to the CCITT recommendation V.110. The first rate adaptation 7, which will be called RA0 in accordance with the GSM standards, adapts asynchronous data for synchronous transmission. The second rate adaptation 8, called RA1 in accordance with the GSM standards, changes the transmission rate into an intermediate rate, which is 8 or 16 kbit/s, and the third rate adaptation 9, called RA2 in accordance with the GSM standards, changes the transmission rate into 64 kbit/s for transmission across the A interface 4 and Abis interface 4a.

The base transceiver station 5 includes an RA2-type adaptation which adapts the data back to the intermediate rate. The data are taken to a handling block 11, in which the frame according to the V.110 standard is adapted for transmission across the radio interface 6. Before the radio interface 6 the data are taken to a forward error correction (FEC) block 12, which together with a corresponding block 13 on the terminal 2 side improves the reliability of the transmission across the radio interface 6. The terminal 2 includes an RA1 and RA0 type adaptation 14, 15, the first of which reconstructs synchronous data and status information and the latter reconstructs asynchronous data. Transmission in the opposite direction includes substantially the same stages in the reverse order.

Figure 2 is a schematic representation of a known non-transparent circuit switched connection between a GSM switching centre 1 and GSM terminal 2. The arrangement differs from that of Figure 1 in that both the switching centre 1 and the terminal 2 include a data protocol block 16, 17; 18, 19 consisting of two sub-blocks which are called L2R (Layer 2 Relay Function) 16; 19 and RLP (Radio Link Protocol) 17; 18. The L2R block 16 of the switching centre 1 arranges the data into protocol data units (PDU) consisting of state octets according to the GSM standard GSM 07.02 which are taken one at a time to the RLP block 17. There the data are arranged into RLP frames according to the GSM standard GSM 04.22, comprising a 16-byte header, a 200-byte information part and a 24-byte frame check sequence (FCS). The complete RLP frames are taken to a rate adaptation including an RA1 type adaptation 8; 14 in the switching centre 1 and terminal 2, and in addition, an RA2 type adaptation 9 in the switching centre.

Below it will be described arrangements according to the invention for implementing data communication between the DECT and GSM, referring to Figure 3 to 8.

A DECT base station, which is called a fixed part (FP) includes an interworking unit 20a to provide data communication in the direction of the switching centre. If a DECT base station 20 (FP) is connected via an interworking unit 20a to a GSM switching centre 1 in a manner which is known, the transmission rate between them is 64 kbit/s and the interface 21 is called an A interface in the same way as in the GSM system described above. According to the invention, RA0, RA1 and RA2 type rate adaptation blocks 24, 23, 22 corresponding to those in the GSM switching centre 1 are added, as shown in Figure 3, to the DECT base station 20, preferably to its interworking unit 20a. When data are transferred from the GSM system to a DECT base station, synchronous data and status information flow from the output of an RA1 type block 23 to DECT protocol blocks (not shown) and from there further in the form required by DECT standards across the DECT radio interface 25 to a DECT terminal 26, which is called a portable part (PP). Asynchronous data are obtained from the output of an RA0 type adaptation block 24. When transferring data in the opposite direction, the DECT protocol blocks (not shown) of the base station 20 forward asynchronous data to the RA0 type block 24 and/or synchronous data and status information to the RA1 type block 23, which send the data via the RA2 type block 22 across the A interface 21 towards the GSM base station 1.

Figure 4 is a schematic representation of the arrangement according to the invention for implementing non-transparent data communication between a GSM switching centre 1 and a DECT base station 20. The same blocks as those in the arrangement of Figure 2 take part in the operation in the GSM switching centre 1. The DECT base station includes a data protocol block comprising an RLP block 27 and an L2R block the operation of which corresponds to that depicted in Figure 2 with the exception that the data transferred in the direction of the terminal 26 are taken from the L2R block 28 of the base station further to the protocol blocks (not shown) of the DECT system and further in the form required by the DECT standards across the DECT radio

interface 25 to the DECT terminal 26.

It is a substantial feature of the described embodiment of the method according to the invention that the transmission chain conforming to the GSM standards ends in a DECT base station 20, advantageously in its interworking unit 20a. Above it has been described the implementation of RA0, RA1 and RA2 type rate adaptations 24, 23, 22 as well as L2R and RLP type data protocols 28, 27 in an interworking unit 20a of a DECT base station. These blocks are used to implement at the rate of 9600 bit/s at the most the asynchronous or synchronous and transparent or non-transparent data communication mentioned above in connection with the description of GSM bearer services.

Above it was also mentioned that these provide a basis for the bearer services listed, and the higher-level telecommunication services in turn use said bearer services. According to the invention, the higher-level blocks that are needed to use said higher-level telecommunication services are also included in the DECT base station 20, preferably in its interworking unit 20a. According to the order specified in the GSM standards, these blocks are placed above the rate adaptations in the base station hierarchy.

A fax service according to Figure 5 and 6 is presented as an example. Figure 5 shows an arrangement according to the invention for implementing transparent fax transmission between a GSM switching centre 1 and a DECT base station 20. Both the switching centre 1 and the base station 20 include a fax adapter (FA) 29; 30 conforming to the T.30 standard, placed above the RA1 type rate adaptation block 8; 23 in the hierarchy. Letters S and D emphasize that according to the T.30 standard the connection can be used to transmit both status information (S) and data (D). In non-transparent fax service there is, as shown in Figure 6, between the RA1 type rate adaptation 8; 23 and the fax adapter 29; 30 a data protocol block 31; 32 that includes L2R and RLP type sub-blocks for implementing error correction in the same way as described above with reference to Figure 4.

Next, referring to Figure 7 and 8, it will be described in greater detail the implementation of the method according to the invention with emphasis on how the data flow between the DECT and GSM blocks in a DECT base station. The arrangement of Figure 7 is a more detailed representation of the case depicted in Figure 3 dealing with transparent data communication according to the invention between a GSM switching centre 1 and a DECT base station 20. Figure 7 includes the lower levels 33, 34 which were not shown in the earlier figures but which in all cases participate in the physical transmission of the signal between different devices, as is clear to a person skilled in the art. In a situation depicted in Figure 7, the status information included in the data flows in a DECT base station 20 between an RA1 type rate adaptation block 23 conforming to the GSM standards and a Ctrl block 36 conforming to the DECT standards. Similarly, synchronous data flow between said RA1 block 23 and a BPAD block 37 conforming to the DECT standards, and asynchronous data flow between an RA0 type adaptation block 24 conforming to the GSM standards and a PAD block 38 conforming to the DECT standards. The base station 20 also includes other blocks conforming to the DECT standards which in the operations hierarchy are placed below said Ctrl, BPAD and PAD blocks 36, 37, 38 and the FI.ctrl block 35 at the same level with them.

Similarly, Figure 8 is a more detailed representation of the situation depicted in Figure 4 dealing with non-transparent data communication according to the invention between a GSM switching centre 1 and a DECT base station 20. In Figure 7 an L2R protocol block 28 as shown in Figure 4 is further divided into a synchronous sub-block 39 (L2BOP, Layer 2 Bit Oriented Protocol) and an asynchronous sub-block 40 (L2COP, Layer 2 Character Oriented Protocol), the first of which is connected to a BPAD block 37 conforming to the DECT standards and the second to a PAD block 38 conforming to the DECT standards. Figure 7 and 8 show that the arrangement according to the invention is both in transparent (Figure 3 and 7) and in non-transparent data communication (Figure 4 and 8) connected to the same blocks 36, 37, 38 conforming to the DECT standards since in the DECT system the radio interface 25 and accordingly the operation of the DECT base station conforming to the standards is identical in both transmission methods.

Data communication conversions between the GSM format and DECT format are shown in detail in tables of the accompanying documents of which the "DECT/GSM interworking of bearer services: implementation description, complete coding mapping of GSM and DECT elements" concerns the first embodiment of the method according to the invention and the "DECT/GSM interworking of bearer services: implementation description, transparent coding transportation of the Bearer Capability" concerns the second embodiment of the method according to the invention.

Next, referring to Figure 9a to 9e, it will be described in greater detail the setting up of a data call between a DECT terminal, a base station employing the method of the invention and a GSM switching centre. The purpose of this description is to illustrate those new functions related to the setup of a data call that are included in a base station employing the method of the invention.

Figure 9a to 9e show a DECT terminal 26, a base station 20 employing the method of the invention and a GSM switching centre 1. The arrows represent messages between equipment and they are arranged in temporal order so that in each figure time flows from top down. For reasons of clarity, the message, parameter and record names related to the DECT standard are typed in upper-case letters in the description, and the corresponding names related to the GSM standard are typed in lower-case letters.

Setting up of a data call originated by a terminal 26 (Figure 9a to 9c) is performed largely in the same manner as defined in the ETS 300 370 standard, but in the so-called service negotiation procedure there are some differences depending on what kind of operation the base station 20 supports. The negotiable parameter is in this case the code < < modem type > > referring to the type of the modem. The minimum requirement for the base station operation is the "negotiation not possible" function according to Figure 9a. To provide this function, no changes are required in the operation of the base station 20 as regards the ETS 300 370 standard. As the interworking unit 20a (not shown) of the base station 20 receives the CC-SETUP message 41 sent by the terminal 26, and the < <NEGOTIATION INDICATOR FIELD> > of the message indicates that the service negotiation is not possible, the interworking unit sends a "Setup" message 42 to the switching centre but prevents negotiation with the switching centre 1. This means that if the switching centre 1 indicates in the "Call proceeding" message 43 that it cannot provide the service requested by the terminal 26, the connection is disconnected using the CC-RELEASE-COM message 44 to the terminal 26 (with the notice "Incompatible service" in the < <RELEASE REASON> > field) and the "Release Complete" message 45 to the switching centre 1.

A second possible procedure for the base station 20 is shown in Figure 9b. When the interworking unit 20a (not shown) of the base station 20 receives the CC-SETUP message 46 sent by the terminal 26, and the < <NEGOTIATION INDICATOR FIELD> > contains a value representing the message "Exchange parameter negotiation", the interworking unit either rejects the negotiation request directly with the message "Negotiation not supported" (not shown) if the base station does not support service negotiation, or it maps the < <IWU-ATTRIBUTES> > and < <END-TO-END-COMPATIBILITY> > records conforming to the DECT standard into the < <bearer capability> > record conforming to the GSM standard in the manner described in tables 7, 11 and 12 of the accompanying document "DECT/GSM interw6rking of bearer services: implementation description, complete coding mapping of GSM and DECT elements" and sends this record to the switching centre 1 in the "Setup" message 47.

If after that the switching centre 1 sends to the base station 20 a "Call proceeding" message 48 with new values in the < < bearer capability> > record, the base station will map those values into the < <IWU-ATTRIBUTES> > and < <END-TO-END-COMPATIBILITY> > records in the CC-RELEASE-COM message 49 sent to the terminal 26 and send a "Release complete" message 50 toward the switching centre 1. Then the terminal 26 may start the process anew by sending a CC-SETUP message 51 containing the new values, after which the data call setup continues according to the manner 52, 53 defined in the ETS 300 370 standard. If the switching centre did not send a "Call proceeding" message or if the message sent did not contain the < <bearer capability> > record, the intermediate stage 49, 50, 51 is not included in the data call setup procedure.

Figure 9c shows a third possible procedure for the base station 20. When the interworking unit 20a (not shown) of the base station 20 receives a CC-SETUP message 54 from the terminal 26 with a value representing the message "Extended exchange parameter negotiation" in the < <NEGOTIATION INDICATOR FIELD> >, it either rejects the negotiation request directly with the message "Negotiation not supported" (not shown) if the base station does not support extended service negotiation, or it maps the < <IWU-ATTRIBUTES> > and < <END-TO-END-COMPATIBILITY>> records conforming to the DECT standard into the < <bearer capability> > record conforming to the GSM standard in the manner described in tables 7, 11 and 12 in the accompanying document "DECT/GSM interworking of bearer services: implementation description, complete coding mapping of GSM and DECT elements" and sends this record to the switching centre 1 in the "Setup" message 55.

If after that the switching centre 1 sends to the base station 20 a "Call proceeding" message 56 with new values in the < <bearer capability> > record, the base station will map those values into the < <IWU-ATTRIBUTES> > and < <END-TO-END-COMPATIBILITY> > records in the CC-CALL-PROCEEDING message 57 sent to the terminal 26 in the manner described in tables 5, 9 and 10 in the accompanying document "DECT/GSM interworking of bearer services: implementation description, complete coding mapping of GSM and DECT elements". If the switching centre did not send a "Call proceeding" message or if the message did not contain the < <bearer capability> > record, the switching centre has accepted the parameters and the mapping of values into the CC-CALL-PROCEEDING message 57 to the terminal 26 is not required.

According to the second embodiment of the method of the invention the < <IWU-ATTRIBUTES> > record conforming to the DECT standard is redefined in the manner described in Chapter 6 of the accompanying document "DECT/GSM interworking of bearer services: implementation description, transparent coding transportation of the Bearer Capability", whereafter the < <IWU-ATTRIBUTES> > record conforming to the new definition fully complies with the requirements of the GSM standard bearer services. The < <IWU-ATTRIBUTES> > record conforming to the new definition makes the selection of the bearer service easier and the < <END-TO-END-COMPATIBILITY> > record need then not be used.

Setting up of a data call received by the terminal 26 (Figure 9d and 9e) is also performed largely as defined in the ETS 300 370 standard, but also in this case there are certain differences in the service negotiation procedure depending on what kind of operation the base station 20 supports. The negotiable parameters in this case

are the number of data, stop and parity bits, use of the user layer 2 protocol and modem type; the codes for these are, respectively, < <number of data bits> >, < <number of stop bits> >, < <number of parity bits> >, < <user layer 2 protocol> > and < <modem type> >. The minimum requirement for the operation of the base station 20 is still the "negotiation not possible" function. To provide this function, no changes are required in the operation of the base station as regards the ETS 300 370 standard because the terminal 26 decides to disconnect if there is the code < <Negotiation not possible> > in the < <NEGOTIATION INDICATOR FIELD> > of the the CC-SETUP message received by the terminal and the values of said parameters are not suitable.

In the case illustrated by Figure 9d the base station 20 supports service negotiation. First it maps the "Set-up" message 58 from the switching centre 1 into a CC-SETUP message 59 conforming to the DECT standard and sends it to the terminal 26. If the terminal 26 does not support service negotiation it rejects the negotiation request directly with the message "Negotiation not supported" (not shown). Otherwise, the terminal 26 adds the appropriate parameters to the < <IWU-ATTRIBUTES> > and < <END-TO-END-COMPATIBILITY> > records in the CC-RELEASE-COM message 60 sent by it to the base station 20. The base station 20 does not map the parameters into any message sent to the switching centre 1 but sends a new CC-SETUP message 61 to the terminal 26 with new values in the < <IWU-ATTRIBUTES> > and < <END-TO-END-COMPATIBILITY> > records. The base station 20 must be able to associate this new CC-SETUP message 61 with the GSM data call that has arrived from the switching centre 1 and is waiting for a response. When the terminal 26 responds to the new CC-SETUP message 61 by sending to the base station 20 a CC-ALERTING or CC-CONNECT message 62, the base station 20 maps the new parameters into the < <bearer capability> > record in the "Call Confirmed" message 63 sent to the switching centre 1 in the manner described in tables 8, 11 and 12 in the accompanying document "DECT/GSM interworking of bearer services: implementation description, complete coding mapping of GSM and DECT elements".

Figure 9e shows an alternative procedure for the case described above. The "Setup" 64 and CC-SETUP 65 messages are handled as above. If the terminal 26 does not support service negotiation it rejects also in this case the service request directly with the message "Negotiation not supported" (not shown). Otherwise, the terminal 26 adds the appropriate parameters to the < <IWU-ATTRIBUTES> > and < <END-TO-END-COMPATIBILITY> > records in the CC-CONNECT message 67 sent to the base station 20. The base station 20 does not send to the switching centre 1 a "Call Confirmed" 68 or "Alerting" 69 message before it has received said parameters. The base station 20 maps the new parameters into the < <bearer capability> > record in the "Call Confirmed" message 68 sent to the switching centre 1 in the manner described in tables 8, 11 and 12 in the accompanying document "DECT/GSM interworking of bearer services: implementation description, complete coding mapping of GSM and DECT elements". Other mappings conform to the ETS 300 370 standard. If the terminal 26 accepts the first parameter values that it received in the CC-SETUP message 65, it will not use the < <IWU-ATTRIBUTES> > and < <END-TO-END-COMPATIBIIITY> > records of the CC-CONNECT message 67, whereby the data call setup proceeds as defined by the ETS 300 370 standard.

With the method according to the invention it is possible to use data services of the GSM system from a terminal belonging to the DECT system because the rate adaptations required by the GSM data services are included in the DECT base station and the transmission format conversions are performed between functional blocks of the base station. The interface to a GSM switching centre of a DECT base station applying the method according to the invention conforms to the GSM standards and, therefore, no changes are needed in the GSM switching centres, and a GSM switching centre does not even have to know that it is transferring data to or from the DECT system. Neither does the method of the invention require changes in the radio interface of the DECT base station to the terminal and, hence, to the user, and so the user does not have to replace his or her DECT terminal with a new one.

The DECT terminal can also be used for using non-GSM-based data services in the same way as before.

Claims

1. A method for using data services of a first telecommunication system from a terminal (26) of a second telecommunication system by means of a base station (20) and a switching centre (1), characterized in that in said base station (20) it is performed rate adaptations and mappings required for the conversions of data between the format of said first telecommunication system and the format of said second telecommunication system.

2. The method of claim 1, characterized in that said first telecommunication system is a GSM system and said second telecommunication system is a DECT system.

3. The method of claim 2, characterized in that in said base station it is performed rate adaptations RA2 (22) and RA1 (23) conforming to the CCITT V.110 standard, required for the conversions of transmission rate between the transmission rate used between said switching centre (1) and said base station (20) and a lower synchronous transmission rate.

4. The method of claim 2 or 3, characterized in that in said base station it is also performed rate adaptation RA0 (24) conforming to the CCITT V.110 standard, required for the conversions of the transmission format between the synchronous and asynchronous transmission modes.

5. The method of any one of claims 2 to 4, characterized in that in said base station it is also performed

- forming of L2COP protocol units according to the GSM standard GSM 07.02 or L2BOP protocol units according to the GSM standard GSM 07.03 and forming of RLP frames according to the GSM standard GSM 04.22 for the data transferred from said terminal to said switching centre and

- unpacking of the RLP frames according to the GSM standard GSM 04.22 and the L2COP protocol units according to the GSM standard GSM 07.02 or L2BOP protocol units according to the GSM standard GSM 07.03 for the data transferred from said switching centre to said terminal.

6. The method of any one of claims 2 to 5, characterized in that in said base station it is also performed for the data transferred a fax adaptation according to the T.30 standard.

7. The method of any one of claims 2 to 6, characterized in that when establishing a connection from said terminal to said switching centre using the service negotiation function according to the GSM standard, said base station, as a response to a "Call proceeding" message (56) sent by said switching centre and containing in the < < bearer capability> > record a value set by said switching centre representing the negotiable connection parameter, will map the value in question into a certain record in the CC-CALL-PROCEEDING message (57) sent to said terminal (26).

8. The method of claim 7, characterized in that said certain record is the < <END-TO-END-COMPATIBILITY> > record or the < <IWU-ATTRIBUTES> > record or both.

9. The method of claim 7 or 8, characterized in that said negotiable connection parameter means the modem type.

10. The method of any one of claims 2 to 9, characterized in that when establishing a connection from said switching centre to said terminal using the service negotiation function according to the GSM standard,

- said terminal, as a response to a CC-SETUP message (65) sent by said base station, will add negotiable connection parameters to a certain record in the CC-CONNECT message (67) which it has sent to said base station 20 and

- said base station, as a response to said CC-CONNECT message (67), will map said negotiable connection parameters into the < <bearer capability> > record in the "Call Confirmed" message (68) sent to said switching centre.

11. The method of claim 10, characterized in that said certain record is the < <IWU-ATTRIBUTES> > or < <END-TO-END-COMPATIBILITY> > record or both.

12. The method of claim 9 or 10, characterized in that said negotiable connection parameters mean one or more of the following: the number of data, stop and parity bits, use of the user layer 2 protocol, and modem type.

13. Equipment, including a base station (20), for using data services of a first telecommunication system from a terminal (26) of a second telecommunication system, characterized in that said base station includes means for performing rate adaptations and mappings required for the conversions of data between the format of said first telecommunication system and the format of said second telecommunication system.

14. The equipment of claim 13, characterized in that said first telecommunication system is a GSM system and said second telecommunication system is a DECT system and said base station (20) includes means for performing rate adaptations RA2 (22) and RA1 (23) according to the CCITT V.110 standard, required for the conversions of transmission rate between the rate used between a GSM switching centre (1) and said base station (20) and a lower synchronous rate.

15. The equipment of claim 14, characterized in that said base station (20) also includes means for performing rate adaptation RA0 (24) according to the CCITT V.110 standard, required for the conversions of the transmission format between the synchronous and asynchronous transmission modes.

16. The equipment of claim 14 or 15, characterized in that said base station (20) also includes means for

- forming L2COP protocol units according to the GSM standard GSM 07.02 or L2BOP protocol units according to the GSM standard GSM 07.03 and performing RLP framing according

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 96 30 4138.9

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.6)
X	WO, A1, 9525407 (SIERRA WIRELESS, INC.), 21 September 1995 (21.09.95) * page 1, line 18 - line 20, abstract * --	1,13	H04Q 7/22 H04Q 7/24 H04Q 7/30
A	EP, A2, 0415502 (PHILIPS ELECTRONIC AND ASSOCIATED INDUSTRIES LIMITED), 6 March 1991 (06.03.91) * page 2, line 6 - line 8; page 2, line 24 - line 25; page 3, line 4 - line 31, page 5 lines 20-32, page 6 rad 3-5, page 13, line 11-12 * --	1-16	
A	EP, A2, 0559957 (GRUNDIG E.M.V), 15 September 1993 (15.09.93) * abstract * --	1-16	
A	US, A, 5384824 (ANTERO ALVESALO), 24 January 1995 (24.01.95) * column 1, line 53 - column 2, line 22, abstract * --	1-16	TECHNICAL FIELDS SEARCHED (Int. Cl.6) H04B H04L H04M H04Q
A	US, A, 5367558 (STEVEN F. GILLIG ET AL), 22 November 1994 (22.11.94) * abstract * --	1-16	

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
STOCKHOLM	27 September 1996	WIK MARCUS

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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A : technological background
O : non-written disclosure
P : intermidiate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

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European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 96 30 4138.9

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.6)
A	WO, A1, 9300778 (GPT LIMITED), 7 January 1993 (07.01.93) * page 2, line 7 - line 14; page 4, line 8 - line 22, abstract * --	1-16	
A	2nd International Conference on Universal Personal ....., Volume 1, 1993, (New York), Olanders Peter, "The role of Cordless Communication i PCS" page 269 - page 273 * -----	1-16	
			TECHNICAL FIELDS SEARCHED (Int. Cl.6)

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
STOCKHOLM	27 September 1996	WIK MARCUS

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P0401)

to the GSM standard GSM 04.22 for the data transferred from said terminal to said switching centre and

- unpacking the RLP frames according to the GSM standard GSM 04.22 and the L2COP protocol units according to the GSM standard GSM 07.02 or L2BOP protocol units according to the GSM standard GSM 07.03 for the data transferred from said switching centre to said terminal.

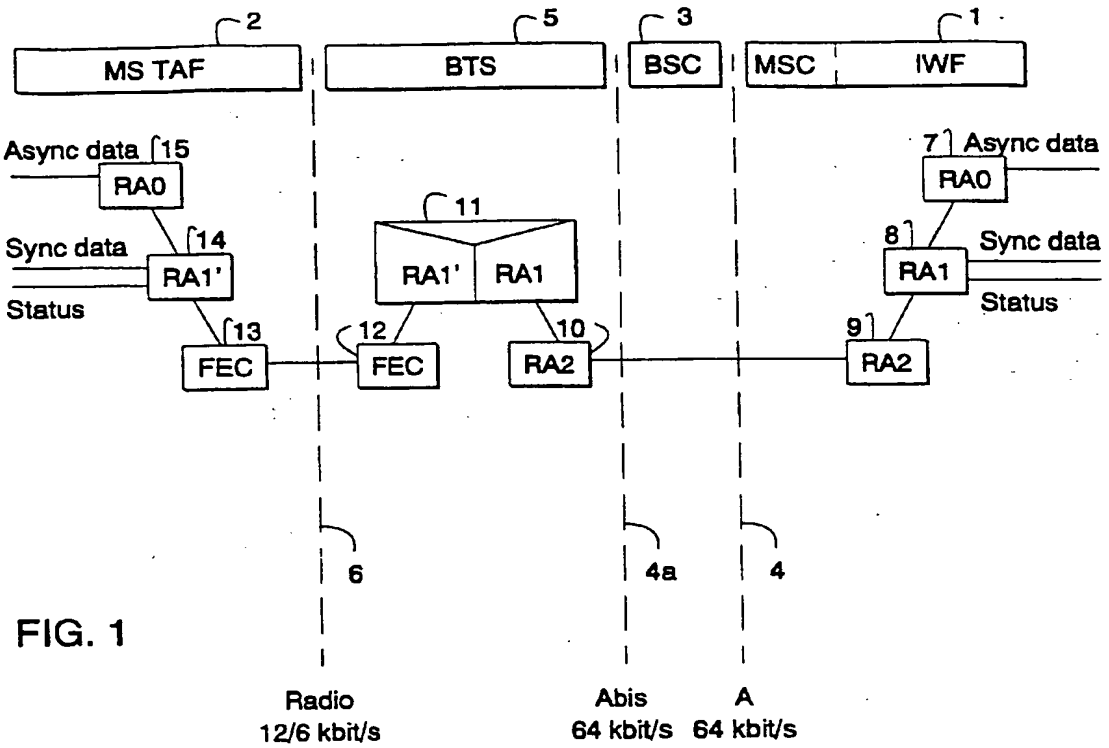
2
5
3
1
MS TAF
BTS
BSC
MSC
IWF
Async data
15
RA0
Sync data
14
RA1'
Status
13
FEC
11
RA1'
RA1
12
FEC
10
RA2
7
Async data
RA0
8
RA1
Sync data
Status
9
RA2
6
4a
4
Radio
12/6 kbit/s
Abis
64 kbit/s
A
64 kbit/s

FIG. 1

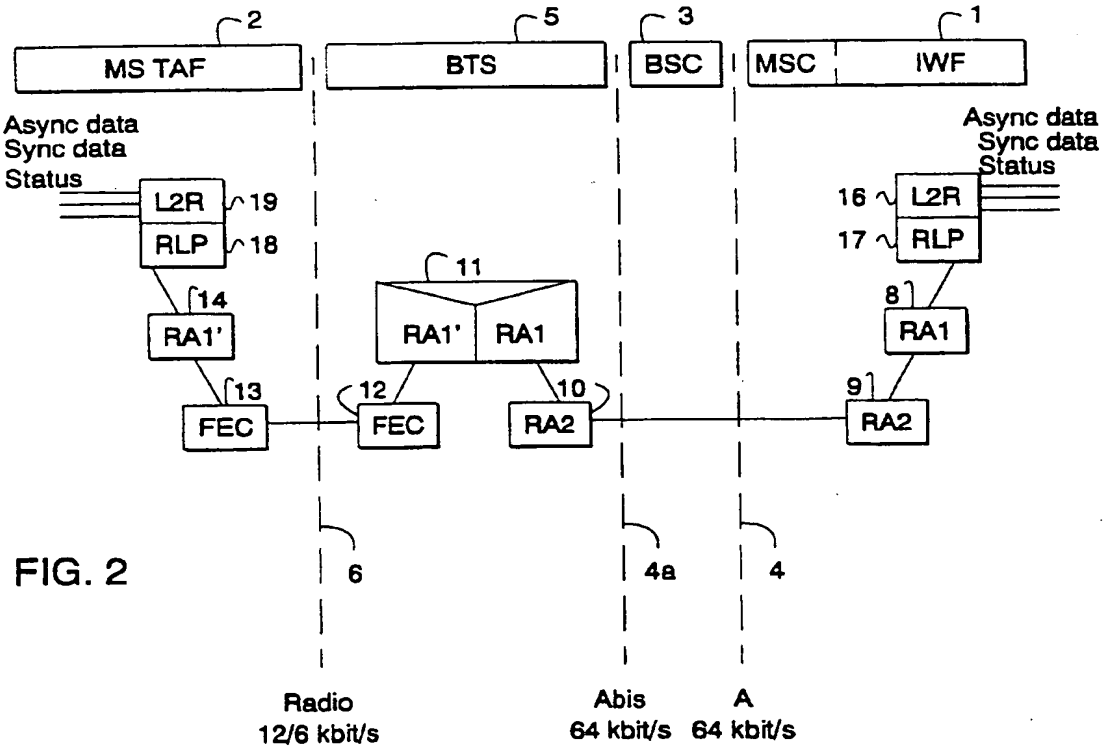
2
5
3
1
MS TAF
BTS
BSC
MSC
IWF
Async data
Sync data
Status
L2R
19
RLP
18
14
RA1'
13
FEC
11
RA1'
RA1
12
FEC
10
RA2
Async data
Sync data
Status
16
L2R
17
RLP
8
RA1
9
RA2
6
4a
4
Radio
12/6 kbit/s
Abis
64 kbit/s
A
64 kbit/s

FIG. 2

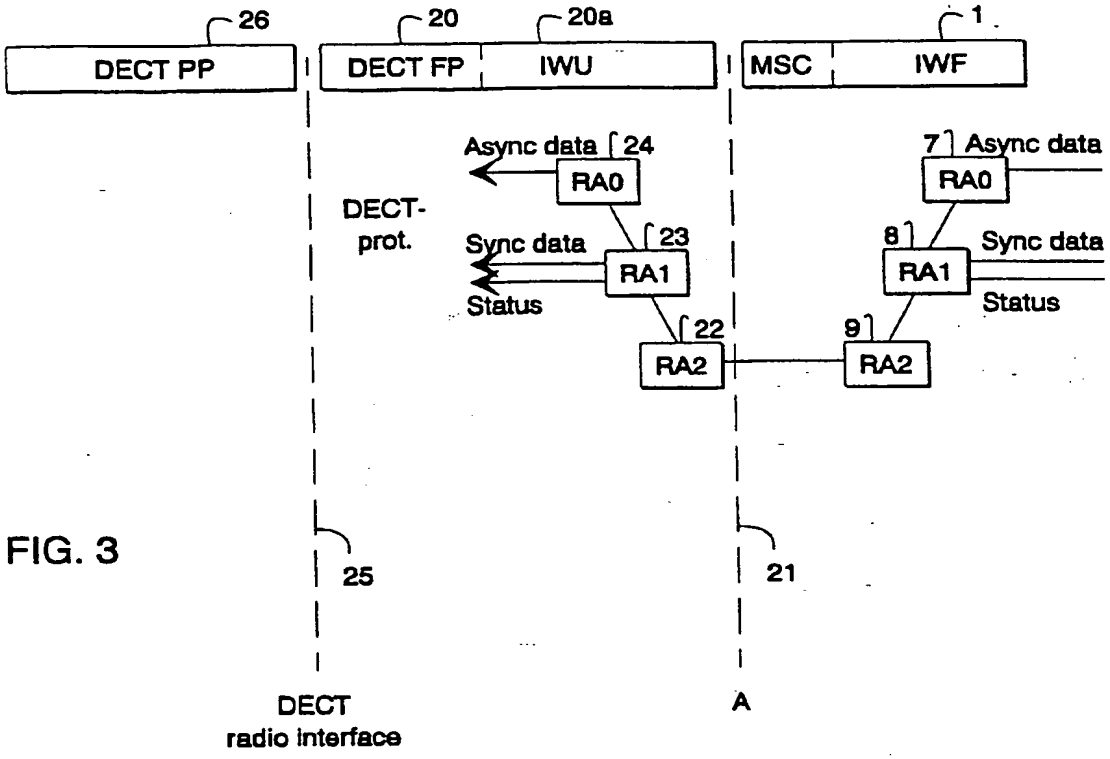
26
20
20a
1
DECT PP
DECT FP
IWU
MSC
IWF
Async data
24
7
Async data
RA0
RA0
DECT-
prot.
Sync data
23
8
Sync data
RA1
RA1
Status
Status
22
9
RA2
RA2
25
21
DECT
radio interface
A

FIG. 3

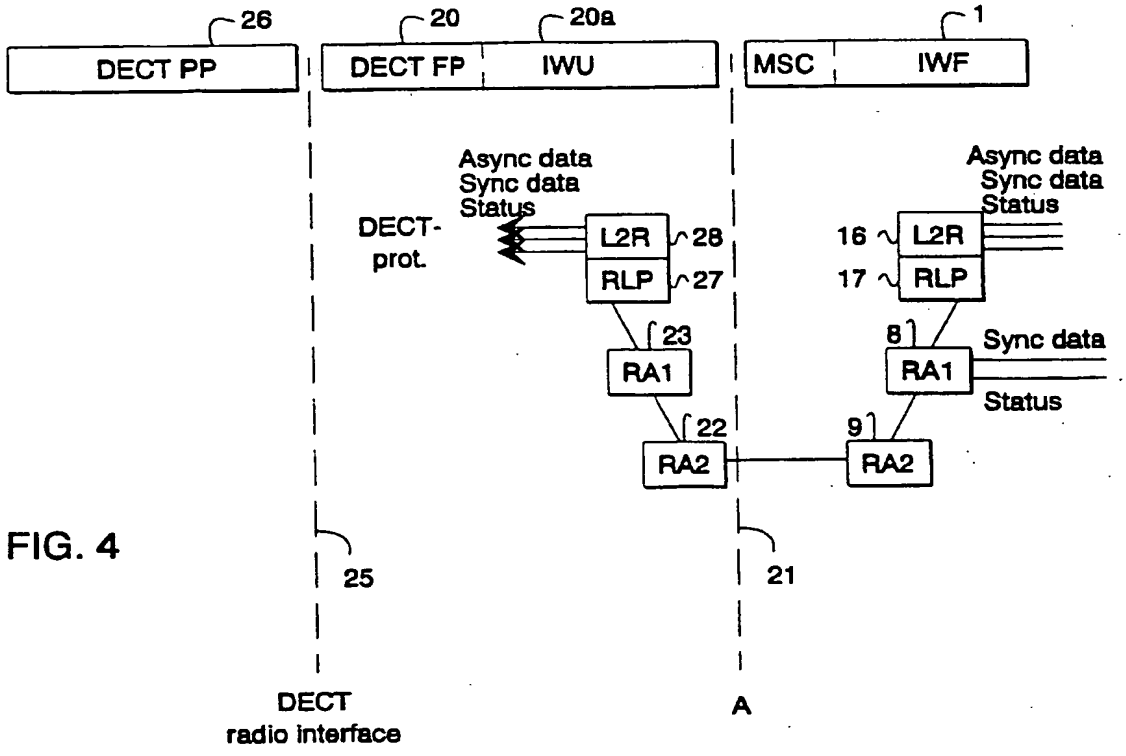
26
20
20a
1
DECT PP
DECT FP
IWU
MSC
IWF
Async data
Sync data
Status
Async data
Sync data
Status
DECT-
prot.
L2R
28
16
L2R
RLP
27
17
RLP
23
8
Sync data
RA1
RA1
Status
22
9
RA2
RA2
25
21
DECT
radio interface
A

FIG. 4

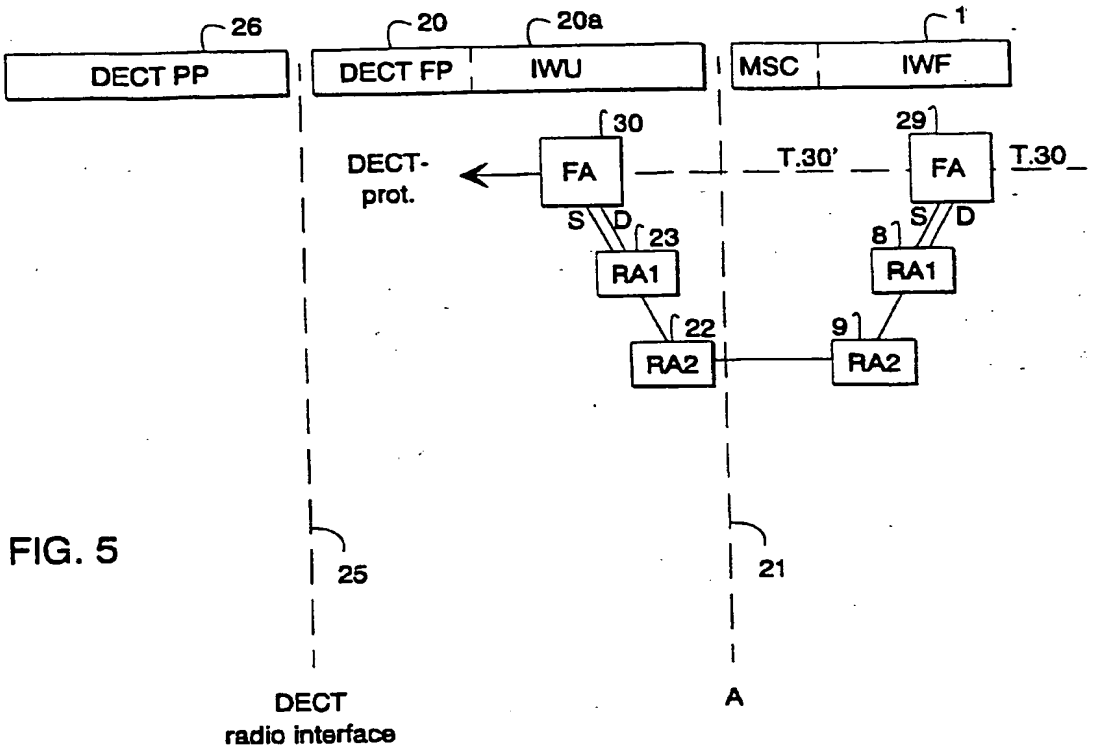
26
20
20a
1
DECT PP
DECT FP
IWU
MSC
IWF
30
29
DECT-
prot.
FA
T.30'
FA
T.30
S
D
23
8
RA1
RA1
22
9
RA2
RA2
25
21
DECT
radio interface
A

FIG. 5

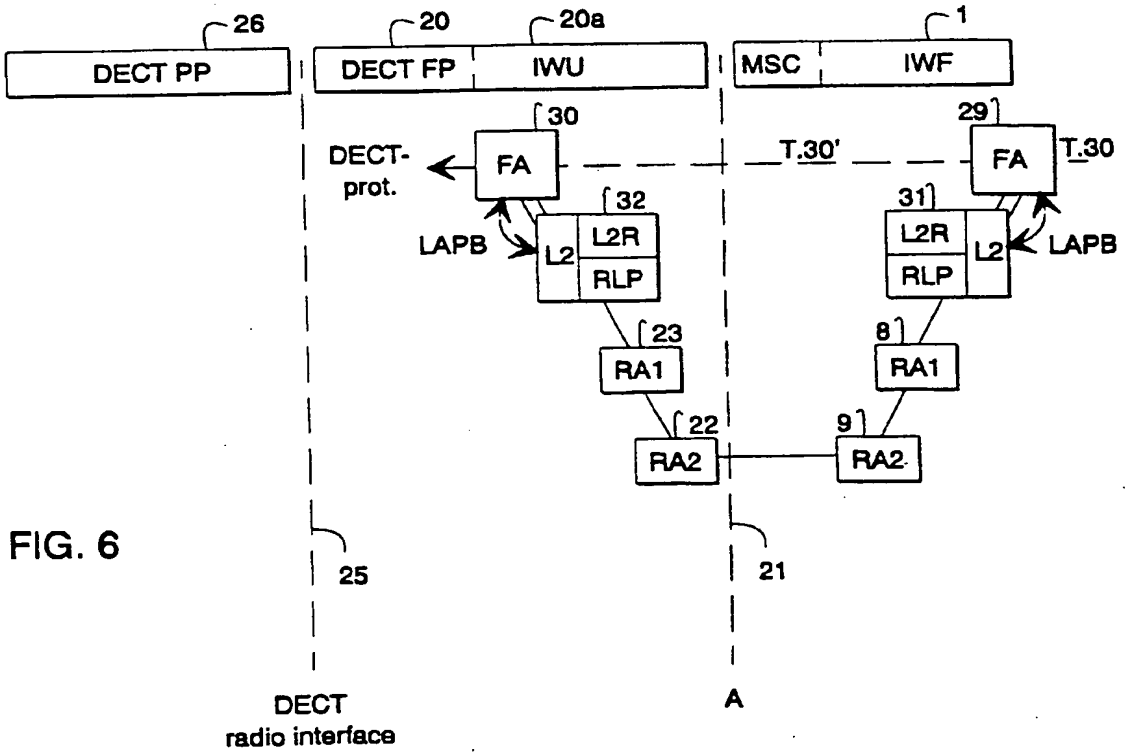
26
20
20a
1
DECT PP
DECT FP
IWU
MSC
IWF
30
29
DECT-
prot.
FA
T.30'
FA
T.30
32
31
LAPB
L2
L2R
RLP
L2R
RLP
L2
LAPB
23
8
RA1
RA1
22
9
RA2
RA2
25
21
DECT
radio interface
A

FIG. 6

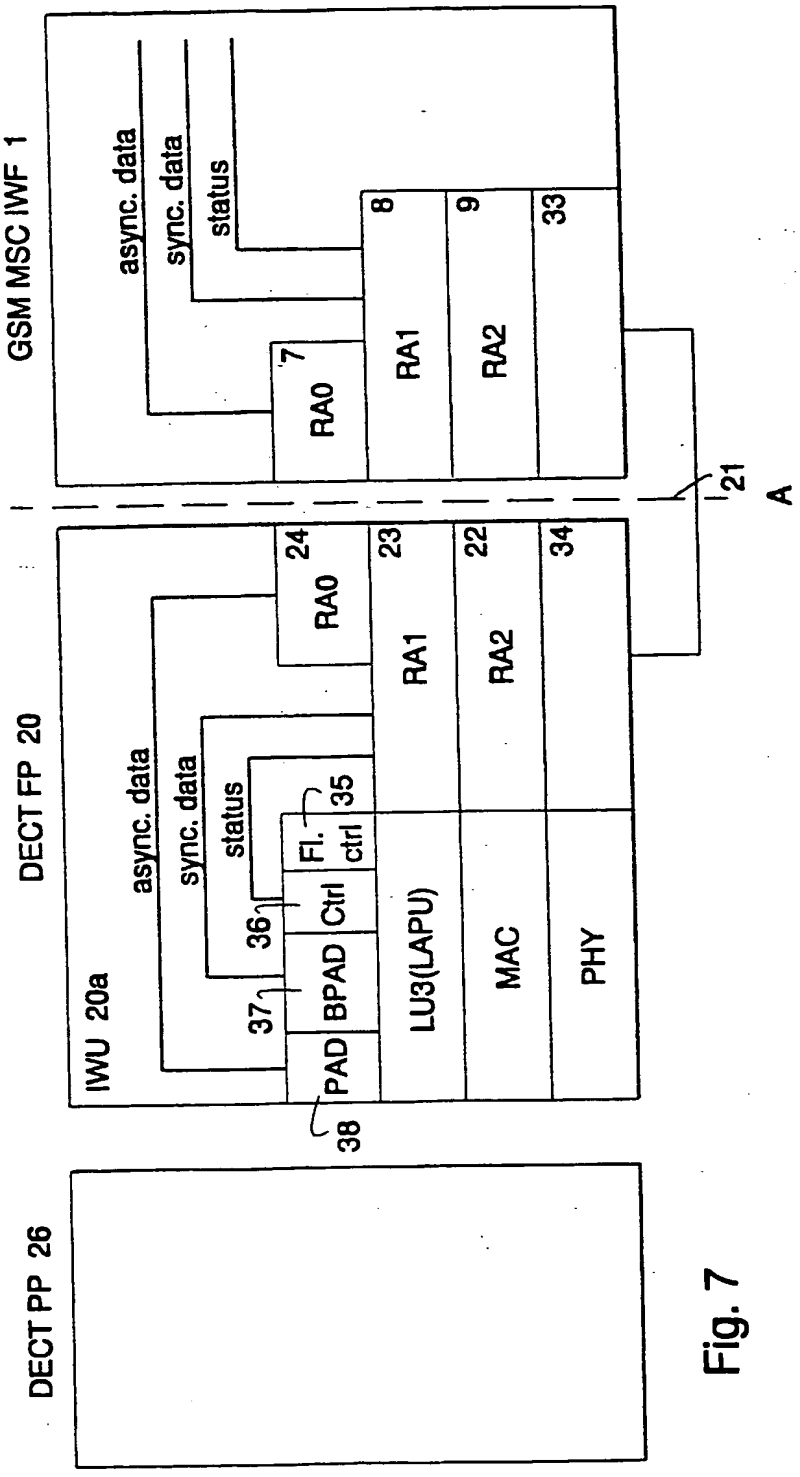
GSM MSC IWF 1
async. data
sync. data
status
7
RA0
8
RA1
9
RA2
33
21
A
DECT FP 20
IWU 20a
async. data
sync. data
status
24
RA0
23
RA1
22
RA2
34
35
Fl. ctrl
36
Ctrl
37
BPAD
PAD
38
LU3(LAPU)
MAC
PHY
DECT PP 26

Fig. 7

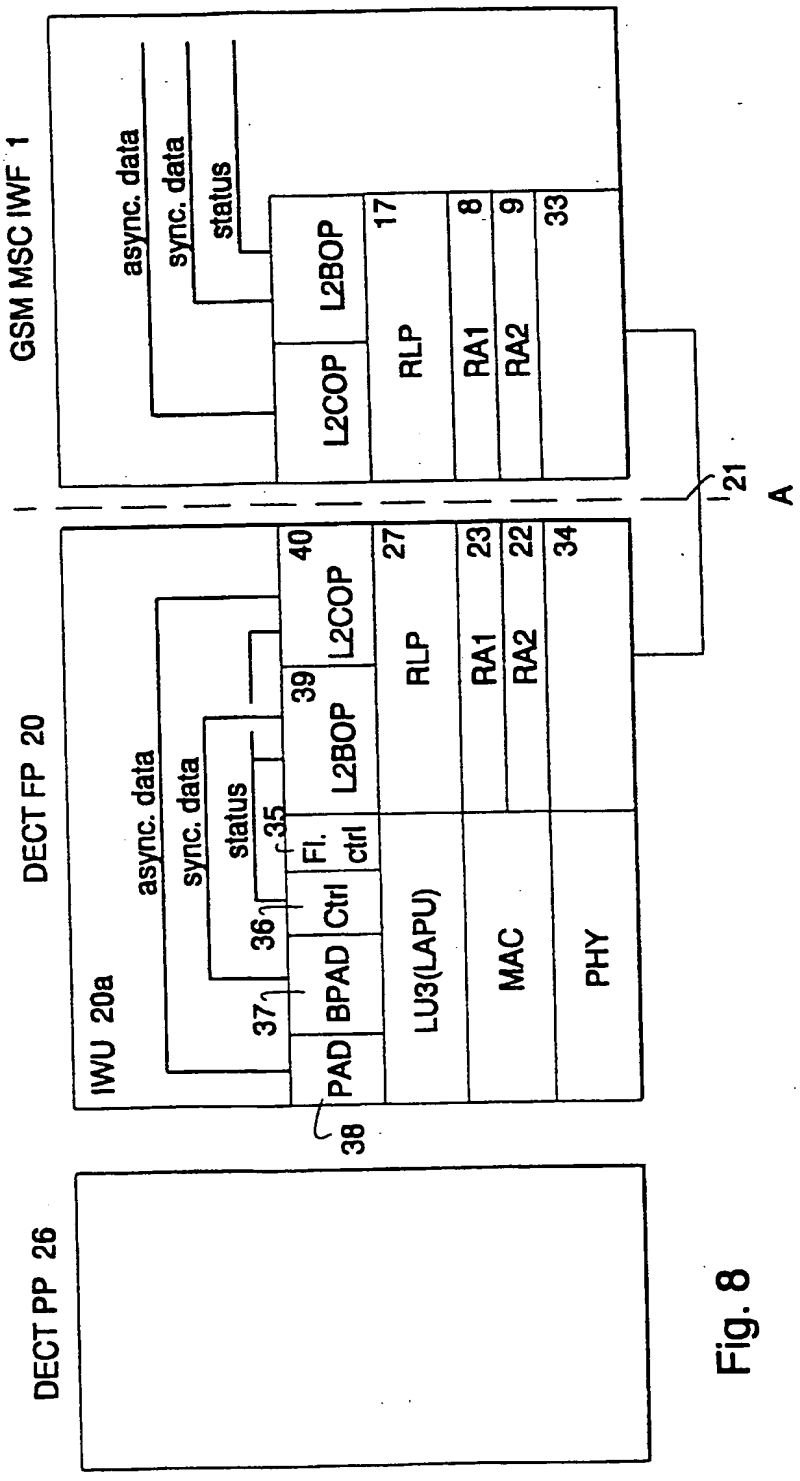
GSM MSC IWF 1
async. data
sync. data
status
L2COP
L2BOP
RLP
RA1
RA2
17
8
9
33
21
A
DECT FP 20
IWU 20a
async. data
sync. data
status
PAD
BPAD
Ctrl
Fl. ctrl
L2BOP
L2COP
LU3(LAPU)
MAC
PHY
RLP
RA1
RA2
40
39
35
36
37
38
27
23
22
34
DECT PP 26

Fig. 8

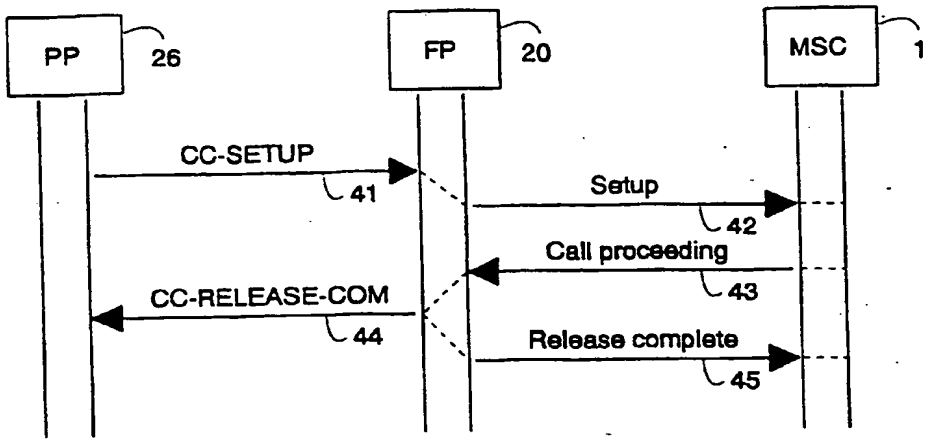

Fig. 9a

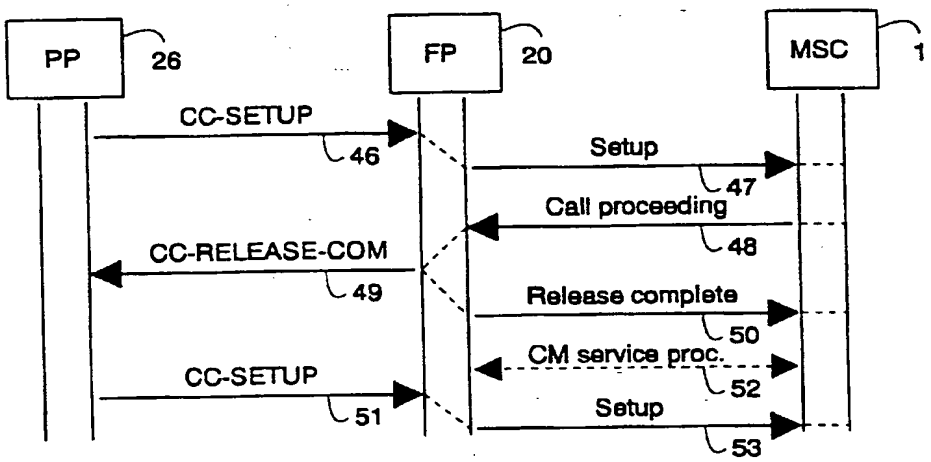

Fig. 9b

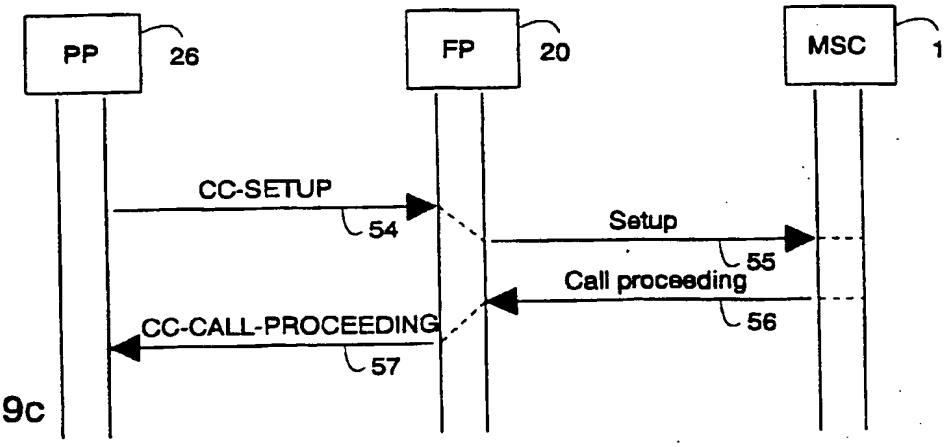

Fig. 9c

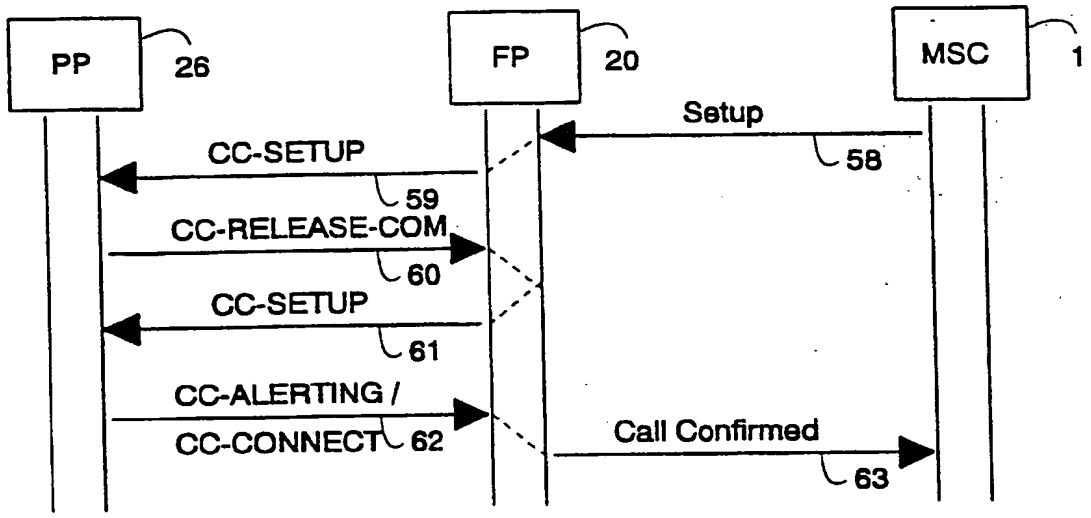
PP
26
FP
20
MSC
1
Setup
58
CC-SETUP
59
CC-RELEASE-COM
60
CC-SETUP
61
CC-ALERTING /
CC-CONNECT
62
Call Confirmed
63

Fig. 9d

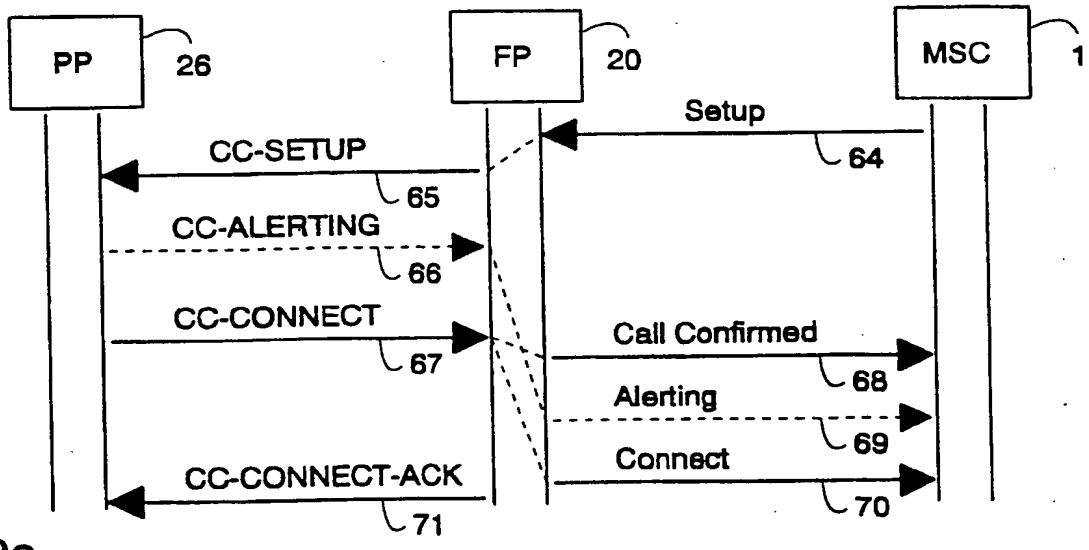
PP
26
FP
20
MSC
1
Setup
64
CC-SETUP
65
CC-ALERTING
66
CC-CONNECT
67
Call Confirmed
68
Alerting
69
Connect
70
CC-CONNECT-ACK
71

Fig. 9e